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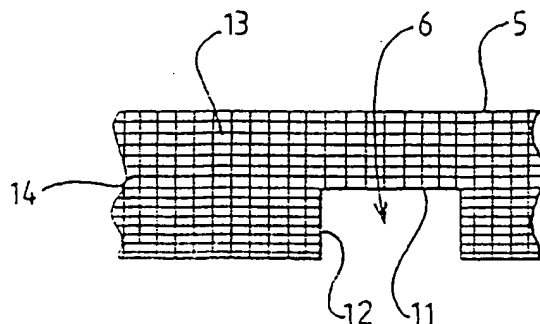
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For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

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(54) Title: AN AIR-BAG



(57) Abstract: An air-bag (1) is disclosed which contains a woven gas supply duct (5). The gas supply duct (5) is configured to be connected to a gas generator and is provided with a plurality of apertures (6) formed therein. The apertures (6) are positioned to direct a flow of gas in the gas supply duct to areas or regions (7, 8, 9) of the air-bag which are to be inflated. The apertures (6) are rectangular apertures, and the edges of the apertures are co-aligned with warp and weft yarns forming the gas supply duct.

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"AN AIR-BAG"

10 **THE PRESENT INVENTION** relates to an air-bag, and more particularly
relates to an air-bag of the type in which an inner gas supply tube is provided
within the air-bag, the gas supply tube being adapted to be connected to a gas
generator, the gas supply tube having apertures formed in the wall thereof to
15 direct gas into discrete inflatable regions or chambers formed within the air-
bag.

It has been proposed to provide an air-bag which has a plurality of
inflatable regions or chambers which are to be supplied with gas from a gas
generator. On example of such an air-bag is so-called "inflatable curtain"
20 which is adapted to be mounted in the roof of the vehicle above the door
openings of the vehicle, and is also adapted, when an accident occurs, to be
deployed to lie adjacent the window openings formed in the door, thus forming
a protective curtain located between the occupant of the vehicle and the side of
the vehicle. Such inflatable curtains provide protection to the occupant of the
25 vehicle in the event of a side impact or roll-over situation.

DE-A-19939618 discloses a safety device of this type in which the
inflatable curtain is formed of an inflatable element which is divided into a
plurality of regions or chambers which are to be inflated. An internal fabric gas

supply duct is provided. That gas supply duct is provided, along its length, with circular apertures formed in the wall of the duct through which gas can flow from the duct into those regions or chambers of the inflatable element which are to be inflated. It has been found that there is frequently substantial damage
5 to the gas supply duct in the region of the circular apertures, especially damage in the form of fraying of the fabric, when the inflatable element has been inflated. This is undesirable since it can lead to an unpredictable inflation characteristic.

10 The present invention seeks to provide an improved air-bag.

According to this invention there is provided an air-bag containing a woven gas supply duct, the gas supply duct being adapted to be connected to a gas generator, and having apertures formed therein; the apertures being
15 positioned to direct a flow of gas in the gas supply duct to areas or regions of the air-bag which are to be inflated, wherein the apertures are rectangular apertures, the edges of the apertures being co-aligned with warp and weft yarns forming the gas supply duct.

20 Preferably the warp and weft yarns are aligned with the axis and extend transverse to the axis of the gas supply duct, the sides of the aperture lying parallel to and transverse to the axis of the duct.

Alternatively the warp and weft yarns extend 45° to the axis of the gas
25 supply duct, the sides of the aperture also lying at 45° to the axis of the supply duct.

Advantageously the air-bag has a plurality of separate regions which are to be inflated and has, at one edge, fixing means to fix the air-bag to part of the roof of a motor vehicle, the air-bag being in the form of an inflatable curtain.

5 The invention also relates to a method of making an air-bag as described above, the method comprising the step of forming said apertures using a laser-cutting technique.

In order that the invention may be more readily understood, and so that
10 further feature thereof may be appreciated, the invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIGURE 1 is a diagrammatic side view of an air-bag in accordance with the invention,

15

FIGURE 2 is an enlarged view of part of Figure 1,

FIGURE 3 is an enlarged view of part of Figure 2, and

20 FIGURE 4 is a view corresponding to Figure 3 illustrating a modified embodiment of the invention.

Referring initially to Figure 1 of the accompanying drawings, an air-bag 1 is illustrated which is intended to form a so-called inflatable curtain. The
25 air-bag 1 has an upper edge 2 provided with a plurality of mounting lugs 3 which are adapted to be connected to a plurality of mounting points provided in the roof-line of the motor vehicle. The mounting points will not be in linear alignment, but will, typically, follow the roof-line of the vehicle and will include mounting points provided on either the "A"-Post or the "C"-Post.

The air-bag is provided with a protruding strap 4 adapted to be connected to a further mounting point.

5 The air-bag is provided, within its interior, with a gas supply duct 5, adapted to be connected, at one end, to a gas generator. The gas supply duct 5 is provided, at selected points spaced along its length, with gas outlet apertures 6. The gas outlet apertures 6 communicate with a plurality of separate inflatable regions 7, 8, 9 of the air-bag. The inflatable region 9 is
10 provided with seams 10 which across it dividing the region 9 into a plurality of substantially parallel chambers. Air-bags of this general design are well known.

Referring now to Figure 2 of the accompanying drawings, which shows
15 part of the air-bag 1 of Figure 1 to an enlarged scale, it can be seen that the fabric gas supply duct 5 is provided with a plurality of apertures 6 which are not of circular form, but which are of rectangular form. Here it is to be understood that in this Specification the term "rectangle" is intended to mean a four-sided plane rectilinear figure with four right angles, and includes, within the
20 definition, a square.

As can be seen more clearly from Figure 3, the aperture 6 that is formed in the gas duct 5 is so orientated that the sides 11 and 12 of the rectangular aperture 6 are co-aligned with the warp and weft fibres 13, 14 of the gas duct 5.
25 The aperture 6 may be cut using a laser cutting technique. It is believed that a rectangular aperture of this type, having the sides of the aperture in alignment with the warp and weft fibres, will lead to a minimum amount of fraying during deployment of the air-bag. The use of a laser-cutting technique will help to "heat-seal" the fibres.

It is to be appreciated that in Figure 3, the warp and weft fibres of the fabric run in alignment with and transverse to the axis of the gas duct 5. The gas duct 5 may, alternatively, be woven in such a way that the warp and weft fibres extend at 45° to the axis of the gas duct, with the gas duct thus effectively being a "braided" tube. In such a situation, an aperture 15 may be provided within the gas duct, as shown in Figure 4, that aperture 15 again being rectangular, and having the sides 16, 17 thereof aligned with the warp and weft fibres 18, 19. The aperture may, therefore, be considered to present a "diamond" shape, but the aperture will still be rectangular.

In the present Specification "comprise" means "includes or consists of" and "comprising" means "including or consisting of".

CLAIMS:

- 5 1. An air-bag containing a woven gas supply duct , the gas supply duct
being adapted to be connected to a gas generator, and having apertures formed
therein, the apertures being positioned to direct a flow of gas in the gas supply
duct to areas or regions of the air-bag 1 which are to be inflated, wherein the
apertures are rectangular apertures, the edges of the apertures being co-aligned
10 with warp and weft yarns forming the gas supply duct .
2. An air-bag arrangement according to Claim 1 wherein the warp and weft
yarns are aligned with the axis and extend transverse to the axis of the gas
supply duct, the sides of the aperture lying parallel to and transverse to the axis
15 of the duct.
3. An arrangement according to Claim 1 wherein the warp and weft yarns
extend 45° to the axis of the gas supply duct, the sides of the aperture also lying
at 45° to the axis of the supply duct.
20
4. An air-bag arrangement according to any one of the preceding Claims
wherein the air-bag has a plurality of separate regions which are to be inflated
and has, at one edge, fixing means to fix the air-bags to part of the roof of a
motor vehicle, the air-bag being in the form of an inflatable curtain.
- 25 5. A method of making an air-bag according to any one of the preceding
Claims, the method comprising the step of forming said apertures using a laser
cutting technique.

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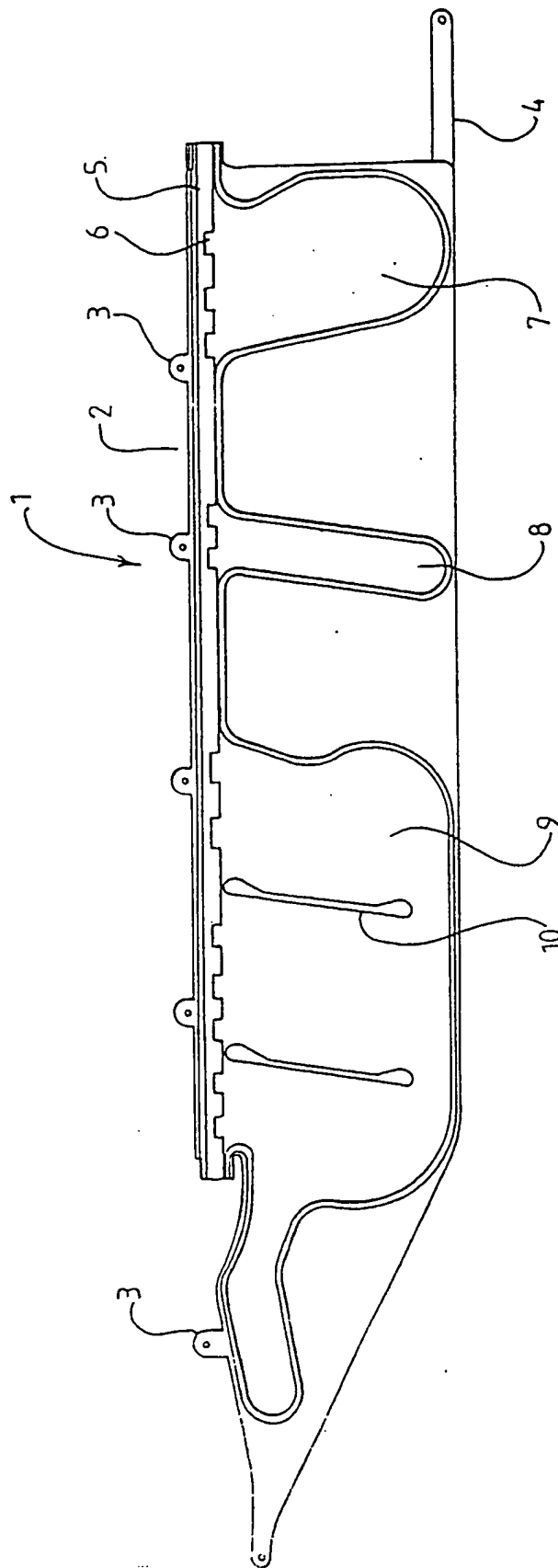
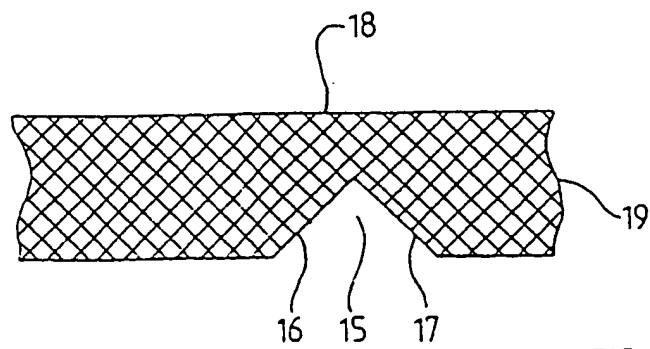
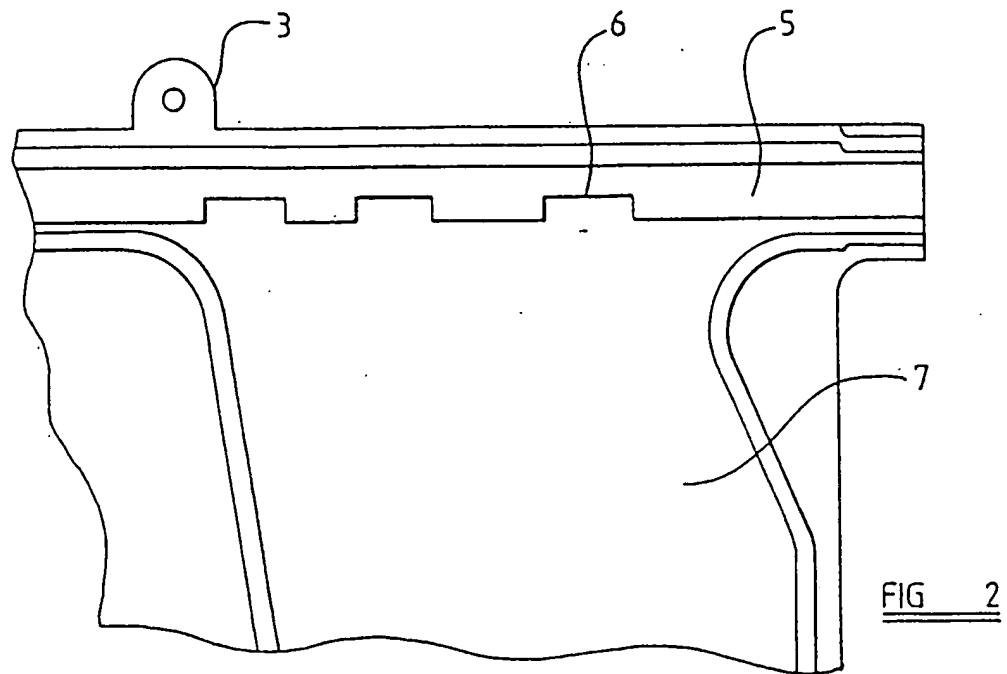
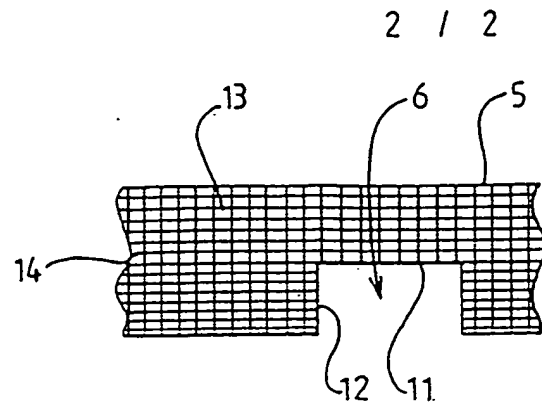


FIG 1



INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 02/02129

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B60R 21/16

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B60R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 19939618 A1 (TAKATA CORP), 18 May 2000 (18.05.00) --	1
A	US 6073961 A (BAILEY ET AL), 13 June 2000 (13.06.00) --	1
P,A	US 6382662 B1 (IGAWA), 7 May 2002 (07.05.02) -- -----	1

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- * "O" document referring to an oral disclosure, use, exhibition or other means
- * "P" document published prior to the international filing date but later than the priority date claimed

- * "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT
Information on patent family members

30/12/02

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Patent document cited in search report			Publication date	Patent family member(s)		Publication date
DE	19939618	A1	18/05/00	JP	2000127886 A	09/05/00
				US	6199898 B	13/03/01
				US	2001019201 A	06/09/01
US	6073961	A	13/06/00	BR	9909265 A	05/12/00
				EP	1054790 A	29/11/00
				JP	2002503581 T	05/02/02
				US	6237941 B	29/05/01
				WO	9942333 A	26/08/99
US	6382662	B1	07/05/02	JP	2001080440 A	27/03/01



INVESTOR IN PEOPLE

Application No: GB 0130225.6
Claims searched: 1 to 5

Examiner: Guy Robinson
Date of search: 21 March 2002

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Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.T): B7B (BSBCC, BSBCR)

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Other: ONLINE: WPI, EPODOC, JAPIO, INTERNET

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	US 6199898 (TAKATA)	-

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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